PATENT SPECIFICATION
DRAWINGS ATTACHED

Inventors: WILLIAM ELI HAIFLEY, EDWARD JOHN SCHAEFER and LEE J. LAKES

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COMPLETE SPECIFICATION

Laminated Core Structure for Electric Machine

We, FRANKLIN ELECTRIC CO., INC., a corporation organized under the laws of the State of Indiana, United States of America, of 400 East Spring Street, Bluffton, Indiana, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to laminated cores for electric machines and more particularly to a novel form of laminated stator core.

The cores used in most present day electric machines are laminated structures having the laminations held together in stacked relation by rivets, welds, keys and the like. It has been found that cores held together by keys or banding strips mounted in grooves extending longitudinally of the core have better magnetic characteristics than riveted or welded cores. However, the various prior cores which used keys or banding strips for holding the laminations assembled have had the serious disadvantage of producing a relatively loose core, that is, such cores are not as rigid as is desired for many uses where the cores may be subjected to vibration or other deforming stresses.

It is a primary object of the present invention to provide a novel laminated core that has excellent magnetic characteristics, is tight and rigid, and is relatively inexpensive to manufacture.

The present invention provides a laminated core for stators of electric machines including a stack of laminations superimposed in face-to-face relation, said stack having a groove across the edges of the respective laminations, said groove being generally rectangular in cross-section, and an elongated strip of banding material positioned in said groove and deformed *in situ* with alternating transversely extending depressed areas and ribs on the top surface of said strip, the bottom surface of said strip under said areas conforming to and in tight frictional engagement with the bottom wall of the groove, and the opposite side edges of the strip adjacent said areas being compressed against the side walls of the groove.

Other objects and advantages of the invention will be apparent from the following description taken in conjunction with the accompanying drawing, wherein

Figure 1 is an end view of a laminated core embodying the features of the present invention;

Figure 2 is an enlarged elevational view of a portion of the edge of the core shown in Figure 1;

Figure 3 is a sectional view taken along line 3—3 of Figure 2; and

Figure 4 is a view similar to Figure 3 showing a modified form of the invention.

A core structure for an electrical machine such as a motor comprises a plurality of laminations held in superimposed face-to-face stacked relation, by longitudinally extending banding-strip material. The laminations are each provided with one or more generally rectangular slots in their peripheral edges. When the laminations are assembled, the slots are aligned and form one or more grooves. Each groove extends from one end of the stack to the other, and mounted in each groove is an associated banding strip which has its opposite ends bent over the ends of the stack of laminations. Each banding strip is in longitudinal tension between its bent ends and also each banding strip is deformed in its associated groove so that the banding strip is in lateral compression between the side walls of its

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associated groove, for tightly gripping the laminations.

The present invention provides banding strips of the foregoing character, which have alternating transversely extending depressed areas and ribs. The strip may be deformed in such a manner as to thicken it at its side edges, particularly in the depressed areas, so that it firmly grips the laminations to hold them in assembled relation.

Apparatus for assembling cores embodying this invention include structure for holding a stack of core laminations in aligned face-to-face compressed relation with the slots in the edges of the laminations forming one or more banding strip receiving grooves. The apparatus also includes structure for supporting a strip of banding material and for laying the strip in the groove upon relative movement between the two structures. The last mentioned structure includes deforming means, such as a serrated roller, adapted to flatten and deform the strip in the groove into holding engagement with the laminations. The banding material is preferably supplied to the apparatus as a continuous strip of flat banding stock, and the apparatus also includes means for preforming the strip, as well as a device for severing or cutting the assembled strip from the remainder of the banding material after banding has been accomplished. The cutting device prepares the end of the remaining portion of the banding strip for the next banding operation. Consequently, the apparatus is adapted to carry out each banding operation quickly and automatically and is thus able to mass produce electrical cores of the preferred form, thereby reducing manufacturing costs.

Figures 1, 2 and 3 of the drawing show a stator core for an electric motor, embodying the features of the present invention. The core comprises a plurality of laminations 11 held in superposed stacked relation, in this instance, by four circumferentially spaced banding strips 12. The laminations 11, in this instance, are generally annular identically shaped sheets of magnetic material. The iner periphery of each lamination is formed in the conventional manner to provide a plurality of circumferentially spaced pole portions, indicated at 13. The pole portions 13 define slots 14 therebetween adapted to accommodate the stator field windings. The inner ends of the pole portions 13 define a circular opening adapted to accommodate the rotor (not shown) of the motor. The outer periphery of each lamination is generally circular so that the core formed thereby may be mounted in a circular motor frame (not shown), but is provided with four circumferentially spaced generally rectangular slots in the edge of each lamination. Thus, when the laminations 11 are stacked in aligned face-to-face relation, as shown, the aligned slots form four banding strip receiving grooves 16 which extend the length of the core.

The banding strip receiving grooves are generally rectangular in cross section and may be deeper in the center than at their side edges. As shown in Figure 3, the groove 16 has a flat-bottom wall 17 and perpendicular side walls 18. In Figure 4, a modified form of banding strip 19 is shown, which is mounted in a modified form of groove having an arcuate bottom wall 21 and side walls 22 which are perpendicular to the chord across the arc of the bottom. The advantages of the different forms shown in Figures 3 and 4 will be discussed hereinafter.

Prior to being mounted in their associated grooves, the banding strips 12 and 19 are preferably longitudinally corrugated so that they are narrower than their associated grooves and thus may be readily placed in the grooves. Upon being placed in these grooves, the banding strips 12 are then flattened by serrated rollers which forms alternating transversely extending depressed areas. Thus, the strip 12 is compressed tightly against the bottom wall 17, and at longitudinally spaced areas the metal of the strip is forced laterally to thicken the edge portions of the strip and force it against the side walls 18, so that the strip is in compression between the side walls. The thickened edges of the strip provide a firm grip on the laminations. In Figure 2, the depressed areas are shown at 23 and are longitudinally spaced and generally concave. Between the depressed areas 23 are laterally extending ribs or portions 24 that are corrugated longitudinally of the strip 12, such corrugating remaining from the original corrugation of the strip.

The opposite ends of the strip 12 are bent over the opposite end laminations of the stack, as shown at 26 in Figures 1 and 2. The bending is accomplished when the stack of laminations is compressed. Thus the strips 12 are in tension between their bent ends 26 and hold the stack of laminations compressed.

The modified form of banding strip 19 shown in Figure 4 differs from the strip 12 in that it is deformed in a groove which, while generally rectangular, has an arcuate bottom 21. This results in the centre portion of the strip 19 being in an over-centre relationship. The exposed surface of the strip 19 has the same general appearance conformation as the strip 12, that is, it has generally concave depressed areas alternating with longitudinally corrugated ribs. Because of the overcentre relation of its center portion with respect to its side or edge portions, and because the strip is curved and hence has substantially the same areas of contact with the sides 22 of the groove as in the previous form, the strip 19 has an increased holding effect on the stack of laminations.

From the foregoing it is apparent that the

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1 SHEET This drawing is a reproduction of the Original on a reduced scale

Fig. 1.

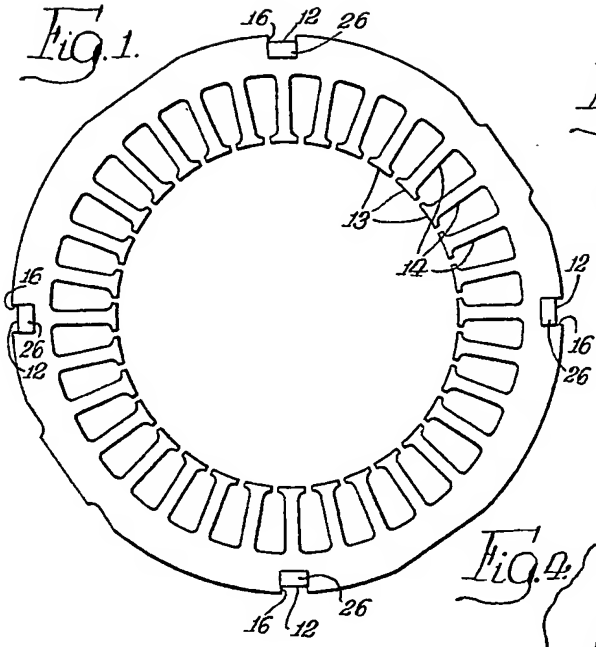

Fig. 3.

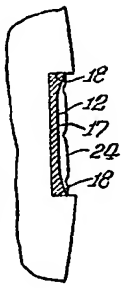

Fig. 4.

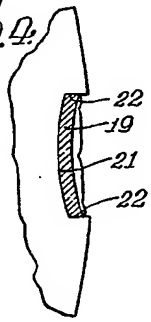

Fig. 2.